Complete Listing of Claims

No amendments are made to the claims. A complete listing of the claims is provided for the Examiner's reference.

1. (Original) An apparatus for extruding a polymeric foam from an extrudate comprising a polymeric resin and a blowing agent for providing the extrudate with a cellular structure upon extrusion, the apparatus comprising:

an extruder having an inlet adapted to receive the extrudate;

an extrusion die having an annular die opening forming an outlet for the extruder through which the extrudate is adapted to be pulled at a predetermined line speed, the extrusion die defining a longitudinal axis, and the annular die opening being concentrically oriented relative thereto and positioned therefrom at a first radial distance;

a choke ring having an opening defined by an annular choke ring surface, the choke ring being positioned relative to the extruder such that the annular die opening is received within the choke ring opening, the choke ring opening being concentric about the longitudinal axis and positioned therefrom a second radial distance; and

wherein the difference between the second radial distance and the first radial distance comprises a gap, the size of the gap being determined by the ratio of the gap (in units of millimeters) to the line speed (in units of millimeters per second) and the ratio ranges from 0.001 to 0.020 second.

2. (Original) An apparatus according to claim 1 wherein the gap is less than 4.57 millimeters.

3. (Original) An apparatus according to claim 2 wherein the gap is less than or equal to 0.8 millimeter.

4. (Original) An apparatus according to claim 3 wherein the gap is about 0.76 millimeter.

5. (Original) An apparatus according to claim 1 wherein the die is symmetrical relative to the longitudinal axis.

6. (Original) An apparatus according to claim 1 wherein the die is a generally cylindrical body having an annular slot defining the die opening.

7. (Original) An apparatus according to claim 6 wherein the die further comprises an annular ridge extending from the cylindrical body and terminating in a peak and the annular slot is located at the peak.

8. (Original) An apparatus according to claim 1 wherein the second radial distance is less than 30 millimeters.

9. (Original) An apparatus according to claim 8 wherein the second radial distance is less than 28 millimeters.

10. (Original) An apparatus according to claim 1 wherein the line speed is 50 to 300 millimeters per second.

11. (Original) An apparatus according to claim 10 wherein the line speed is less than 250 millimeters per second.

12. (Original) An apparatus according to claim 1 wherein the ratio of the gap to the line speed is less than 0.008 second.

13. (Original) An apparatus according to claim 12 wherein the ratio of the gap to the line speed is less than 0.005 second.

14. (Original) An apparatus according to claim 12 wherein the gap is less than or equal to 0.8 millimeter.

15. (Original) An apparatus according to claim 14 wherein the line speed is less than 250 millimeters per second.

16. (Original) An apparatus according to claim 15 wherein the second radial distance is less than 28 millimeters.

17. (Original) An apparatus for extruding a polymeric foam from an extrudate comprising a polymeric resin and a blowing agent for providing the extrudate with a cellular structure upon extrusion, the apparatus comprising:

an extruder having an inlet adapted to receive the extrudate;

an extrusion die having an annular die opening forming an outlet for the extruder through which the extrudate is adapted to be pulled at a predetermined line speed, the extrusion die defining a longitudinal axis, and the annular die opening being concentrically oriented relative thereto and positioned therefrom at a first radial distance;

a choke ring having an opening defined by an annular choke ring surface, the choke ring being positioned relative to the extruder such that the annular die opening is received within the choke ring opening, the choke ring opening being concentric about the longitudinal axis and positioned therefrom a second radial distance; and

wherein the difference between the second radial distance and the first radial distance defines a gap between the choke ring and the die opening and the gap is set so that the extrudate leaving the annular die opening contacts the annular choke ring surface within a contact time of 1.0 to 20.0 milliseconds.

18. (Original) An apparatus according to claim 17 wherein the gap is less than 4.57 millimeters.

19. (Original) An apparatus according to claim 18 wherein the gap is less than or equal to 0.8 millimeter.

20. (Original) An apparatus according to claim 19 wherein the gap is about 0.76 millimeter.

21. (Original) An apparatus according to claim 17 wherein the second radial distance is less than 30 millimeters.

22. (Original) An apparatus according to claim 21 wherein the second radial distance is less than 28 millimeters.

23. (Original) An apparatus according to claim 17 wherein the line speed is 50 to 300 millimeters per second.

24. (Original) An apparatus according to claim 23 wherein the line speed is less than 250 millimeters per second.

25. (Original) An apparatus for extruding a polymeric foam from an extrudate comprising a polymeric resin and a blowing agent for providing the polymeric resin with a cellular structure upon extrusion, the apparatus comprising:

an extruder having an inlet adapted to receive an extrudate;

an extrusion die having an outer periphery with an annular die opening located in the outer periphery and forming an outlet for the extruder, the outer periphery of the extrusion die being located at the annular die opening, the extrusion die defines a longitudinal axis, and the annular die opening is concentrically oriented relative thereto and positioned therefrom at a first radial distance;

a choke ring having a choke ring opening defined by an annular choke ring surface and the choke ring is positioned relative to the extruder such that the annular die opening is received within the choke ring opening, the choke ring opening is concentric about the longitudinal axis and positioned therefrom a second radial distance; and

wherein the difference between the second radial distance and the first radial distance defines a gap between the choke ring and the die opening and the gap is less than 4.57 millimeters.

26. (Original) An apparatus according to claim 25 wherein the gap is less than or equal to 0.8 millimeter.

27. (Original) An apparatus according to claim 26 wherein the gap is about 0.76 millimeter.

28. (Original) An apparatus according to claim 25 wherein the die is symmetrical relative to the longitudinal axis.

29. (Original) An apparatus according to claim 25 wherein the die is a generally cylindrical body having an annular slot defining the die opening.

30. (Original) An apparatus according to claim 25 wherein the second radial distance is less than 30 millimeters.

31. (Original) An apparatus according to claim 30 wherein the second radial distance is less than 28 millimeters.

32. (Original) An apparatus according to claim 25 wherein the line speed is 50 to 300 millimeters per second.

33. (Original) An apparatus according to claim 32 wherein the line speed is less than 250 millimeters per second.

34. (Original) An apparatus for extruding a polymeric foam from an extrudate comprising a polymeric resin and a blowing agent for providing the extrudate with a cellular structure upon extrusion, the apparatus comprising:

an extruder having an inlet adapted to receive the extrudate;

an extrusion die having an annular die opening forming an outlet for the extruder through which the extrudate is adapted to be pulled at a predetermined line speed, the extrusion die defining a longitudinal axis, and the annular die opening being concentrically oriented relative thereto and positioned therefrom at a first radial distance;

a choke ring having an opening defined by an annular choke ring surface, the choke ring being positioned relative to the extruder such that the annular die opening is received within the choke ring opening, the choke ring opening being concentric about the longitudinal axis and positioned therefrom a second radial distance; and

wherein the difference between the second radial distance and the first radial distance defines a gap between the choke ring and the die opening and the gap is less than 4.57 millimeters.

35. (Original) An apparatus according to claim 34 wherein the gap is less than or equal to 0.8 millimeter.

36. (Original) An apparatus according to claim 35 wherein the gap is about 0.76 millimeter.

37. (Original) An apparatus according to claim 34 wherein the die is symmetrical relative to the longitudinal axis.

38. (Original) An apparatus according to claim 34 wherein the die is a generally cylindrical body having an annular slot defining the die opening.

39. (Original) An apparatus according to claim 34 wherein the second radial distance is less than 30 millimeters.

40. (Original) An apparatus according to claim 39 wherein the second radial distance is less than 28 millimeters.

41. (Original) An apparatus according to claim 34 wherein the line speed is 50 to 300 millimeters per second.

42. (Original) An apparatus according to claim 41 wherein the line speed is less than 250 millimeters per second.

43. (Original) An apparatus for extruding a polymeric foam from an extrudate comprising a polymeric resin and a blowing agent for providing the polymeric resin with a cellular structure upon extrusion, the apparatus comprising:

an extruder having an inlet adapted to receive an extrudate;

an extrusion die having an outer periphery with an annular die opening located in the outer periphery and forming an outlet for the extruder, the outer periphery of the extrusion die being located at the annular die opening, the extrusion die defines a longitudinal axis, and the annular die opening is concentrically oriented relative thereto and positioned therefrom at a first radial distance;

a choke ring having a choke ring opening defined by an annular choke ring surface and the choke ring is positioned relative to the extruder such that the annular die opening is received within the choke ring opening, the choke ring opening is concentric about the longitudinal axis and positioned therefrom a second radial distance; and

wherein the difference between the second radial distance and the first radial distance defines a gap between the choke ring and the die opening and the gap is set so that the extrudate leaving the annular die opening contacts the annular choke ring surface within a contact time of 1.0 to 20.0 milliseconds.

44. (Original) An apparatus according to claim 43 wherein the gap is less than 4.57 millimeters.

45. (Original) An apparatus according to claim 44 wherein the gap is less than or equal to 0.8 millimeter.

46. (Original) An apparatus according to claim 45 wherein the gap is about 0.76 millimeter.

47. (Original) An apparatus according to claim 43 wherein the die is symmetrical relative to the longitudinal axis.

48. (Original) An apparatus according to claim 43 wherein the die is a generally cylindrical body having an annular slot defining the die opening.

49. (Original) An apparatus according to claim 43 wherein the second radial distance is less than 30 millimeters.

50. (Original) An apparatus according to claim 49 wherein the second radial distance is less than 28 millimeters.

51. (Original) An apparatus according to claim 43 wherein the line speed is 50 to 300 millimeters per second.

52. (Original) An apparatus according to claim 51 wherein the line speed is less than 250 millimeters per second.

53. (Original) An apparatus for extruding a polymeric foam from an extrudate comprising a polymeric resin and a blowing agent for providing the polymeric resin with a cellular structure upon extrusion, the apparatus comprising:

an extruder having an inlet adapted to receive an extrudate;

an extrusion die having an outer periphery with an annular die opening located in the outer periphery and forming an outlet for the extruder through which the extrudate is adapted to be pulled at a predetermined line speed, the outer periphery of the extrusion die being located at the annular die opening, the extrusion die defines a longitudinal axis, and the annular die opening is concentrically oriented relative thereto and positioned therefrom at a first radial distance;

a choke ring having a choke ring opening defined by an annular choke ring surface and the choke ring is positioned relative to the extruder such that the annular die opening is received within the choke ring opening, the choke ring opening is concentric about the longitudinal axis and positioned therefrom a second radial distance; and

wherein the difference between the second radial distance and the first radial distance comprises a gap, the size of the gap being determined by the ratio of the gap (in units of millimeters) to the line speed (in units of millimeters per second) and the ratio ranges from 0.001 to 0.020 second.

54. (Original) An apparatus according to claim 53 wherein the gap is less than 4.57 millimeters.

55. (Original) An apparatus according to claim 54 wherein the gap is less than or equal to 0.8 millimeter.

56. (Original) An apparatus according to claim 55 wherein the gap is about 0.76 millimeter.

57. (Original) An apparatus according to claim 53 wherein the die is symmetrical relative to the longitudinal axis.

58. (Original) An apparatus according to claim 57 wherein the die is a generally cylindrical body having an annular slot defining the die opening.

59. (Original) An apparatus according to claim 53 wherein the second radial distance is less than 30 millimeters.

60. (Original) An apparatus according to claim 59 wherein the second radial distance is less than 28 millimeters.

61. (Original) An apparatus according to claim 53 wherein the line speed is 50 to 300 millimeters per second.

62. (Original) An apparatus according to claim 61 wherein the line speed is less than 250 millimeters per second.

63. (Original) An apparatus according to claim 53 wherein the ratio of the gap to the line speed is less than 0.008 second.

64. (Original) An apparatus according to claim 63 wherein the ratio of the gap to the line speed is less than 0.005 second.